REMARKS

Claims 4, 6, 8, 10 and 12 were previously pending in the application. In the Office Action mailed on April 29, 2009, claims 4, 6, 8, 10 and 12 were rejected. In the Amendment filed on July 29, 2009, claim 12 was canceled, without prejudice; and claims 4, 6, 8 and 10 were amended to correct a grammatical error. Applicants filed a notice of appeal on October 29, 2009. In the Advisory Action mailed December 23, 2009, the Examiner indicated that the amendments were entered. However, the rejection of claims 4, 6, 8 and 10 was maintained.

In the instant Amendment, new claims 13-18 have been added. Support for the new claims is found in the specification at page 2, lines 13-17; page 3, lines 1-6; page 11, lines 12-15; page 13, lines 22-27; page 16, Table 1; and page 17, Table 2. Upon entry of the instant Amendment, claims 4, 6, 8, 10 and 13-18 will be pending.

No new matter has been added by these amendments. Entry of the foregoing amendments, and consideration of the following remarks is respectfully requested.

APPLICANTS' INTERVIEW SUMMARY

Applicants wish to thank Examiner Jason Savage and Supervisory Examiner Jennifer McNeil for the courtesies extended to Applicants' representative Messrs. Patrick Birde and Weining Wang for the interview conducted on April 20, 2010. During the interview, the present invention and its differences from the cited references were discussed.

Applicants' representatives explained to the examiners the background of the present invention. Specifically, high strength thick steel plates and welded structures of such plates are critical for, *e.g.*, the construction of large container ships. The welded joints of such plate are prepared by large-heat-input welding. In large-heat-input welding, *e.g.*, with a heat input of 159 kJ/cm or more, cooling of the welded joint is slower than in small-heat-input welding, *e.g.*, with a heat input of 10-40 kJ/cm. The heat affected zone (HAZ) in a welded joint produced by large-heat-input welding has a coarser microstructure as compared to the HAZ in a welded joint produced by small-heat-input welding, leading to a lower HAZ hardness. Applicants have discovered that conventional large-heat-input welded joint of high strength steel plates over 50 mm in thickness often suffers from low fracture toughness despite having excellent Charpy value, due in part to local stress caused by the hardness difference between the weld metal and the base metal. Applicants further discovered that in a large-heat-input

welded joint of thick high strength steel plates, local stress increases with the increase of the hardness of the weld metal, and that fracture resistance can be significantly improved by controlling, *inter alia*, the hardness of the weld metal to no higher than 110% of the hardness of the base metal. Applicants' representatives directed the attention of the Examiners to Figure 1 of the application, which demonstrates the criticality of controlling the hardness of the weld metal to no higher than 110% of the hardness of the base metal.

In contrast, the primary reference Yoshiyuki is not concerned with welded joints produced from steel plates of 50 mm or more in thickness or produced by large-heat-input welding. Regarding plate thickness, Yoshiyuki's disclosure of 50 mm or more in ¶ [0037] is an error, which a person skilled in the art would have recognized. Yoshiyuki does not disclose the low fracture toughness problem associated with a conventional large-heat-input welded joint of high strength steel plates over 50 mm in thickness, nor the solution to the problem by controlling, *inter alia*, the hardness of the weld metal to no higher than 110% of the hardness of the base metal.

None of the secondary references discloses controlling the hardness of the weld metal to no higher than 110% of the hardness of the base metal to achieve excellent brittle fracture resistance in a large-heat-input welded joint of high strength steel plate of 50 mm thick or more. Each of these references discloses welded joints of either steel plates of no more than 50 mm thick or produced by small-heat-input or both.

Applicants' representatives agreed that Applicants will file a Declaration under 37 C.F.R. §1.132 to describe the above-discussed distinctions between the present invention and the cited references.

REJECTIONS UNDER 35 U.S.C. § 103(a)

Claims 4, 6 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over JP2001-73071 ("Yoshiyuki") in view of JP3-153828 ("Shigeru") or JP2001-001148 ("Tomomasa"). Claims 8 and 10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshiyuki in view of Shigeru or Tomomasa, further in view of JP 2002-161329 ("Hasegawa"). Claim 12 has been canceled.

As discussed in the Declaration under 37 C.F.R. §1.132 ("the Declaration") filed concurrently herewith, "large-heat-input welding" refers to a welding process having a heat

input of at least about 50 kJ/cm, whereas "small-heat-input welding" refers to a welding process having a heat input of about 50 or less kJ/cm. In large-heat-input welding, *e.g.*, with a heat input of 159 kJ/cm or more, cooling of the welded joint is slower than in small-heat-input welding, *e.g.*, with a heat input of 10-40 kJ/cm. As a result, the HAZ in a welded joint produced by large-heat-input welding has a coarser micro-structure as compared to the HAZ in a welded joint produced by small-heat-input welding, leading to a lower HAZ hardness. Applicants have discovered that conventional large-heat-input welded joint of high strength steel plates over 50 mm in thickness often suffers from low fracture toughness despite having excellent Charpy values. Applicants have also discovered that the low fracture toughness is due in part to local stress caused by the hardness difference between the weld metal and the base metal, and that in a large-heat-input welded joint of thick high strength steel plates, local stress increases with the increase of the hardness of the weld metal. Applicants have also discovered that fracture resistance can be significantly improved by controlling, *inter alia*, the hardness of the weld metal to no higher than 110% of the hardness of the base metal. See, the Declaration.

In contrast to the claimed invention, Yoshiyuki does not disclose controlling the hardness of the weld metal to no higher than 110% of the hardness of the base metal to achieve excellent brittle fracture resistance in a large-heat-input welded joint of high strength steel plate of 50 mm thick or more. In fact, Yoshiyuki is not concerned with welded joints produced from steel plates of 50 mm or more in thickness or produced by large-heat-input welding. Yoshiyuki's disclosure of 50 mm or more in ¶ [0037] is an error, which a person skilled in the art would have recognized (see, the Declaration). Yoshiyuki discloses a steel composition devised to provide a base metal that softens only marginally when affected by the weld heat resulting in a small hardness difference between the base metal and the HAZ, thereby improving the fatigue strength and reducing the occurrence of stress-corrosion-cracking. See, Yoshiyuki, ¶ [0044]. A comparison of the hardness of the HAZ between the welded joints of Yoshiyuki and the welded joints of the present invention demonstrates the significant structural difference between the welded joints of Yoshiyuki and the present invention (see, the Declaration).

Thus, Yoshiyuki neither recognize the low fracture toughness problem associated with a conventional large-heat-input welded joint of high strength steel plates over 50 mm in

thickness, nor discloses the solution to the problem by controlling, *inter alia*, the hardness of the weld metal to no higher than 110% of the hardness of the base metal.

None of the secondary references discloses controlling the hardness of the weld metal to no higher than 110% of the hardness of the base metal to achieve excellent brittle fracture resistance in a large-heat-input welded joint of high strength steel plate of 50 mm thick or more. Each of these references discloses welded joints of steel plates of either no more than 50 mm thick or produced by small-heat-input or both (see, the Declaration). Therefore, none of the secondary references cures the deficiencies of Yoshiyuki.

For at least the above reasons, Applicants respectfully submit that claims 4, 6, 8 and 10 are not obvious under 35 U.S.C. § 103(a) over Yoshiyuki, Shigeru, Tomomasa and Hasegawa, either alone or taken together.

It is submitted that in view of the foregoing amendments and remarks, the application is in condition for allowance. It is therefore respectfully requested that the application be allowed and passed for issue.

Respectfully submitted,

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